Group A *Streptococcus* Surveillance Report 2007

Oregon Active Bacterial Core Surveillance (ABCs)
Office of Disease Prevention & Epidemiology
Oregon Department of Human Services
Updated: July 2008

Background

Active Bacterial Core surveillance (ABCs) is a core component of the Emerging Infections Program (EIP) Network sponsored by the Centers for Disease Control and Prevention (CDC). The purpose of ABCs is to determine the incidence and epidemiologic characteristics of invasive disease due to *Haemophilus influenzae*, *Neisseria meningitidis*, group A *Streptococcus* (GAS), group B *Streptococcus* (GBS), and methicillin-resistant *Staphylococcus aureus* (MRSA). The entire EIP Network represents 35.6 million persons in 10 surveillance areas around the United States. More information on the EIP/ABCs Network is found at: http://www.cdc.gov/ncidod/dbmd/abcs.

In Oregon, the surveillance area for invasive GAS disease comprises the Tri-County (Clackamas, Multnomah, and Washington) Portland metropolitan area with a 2007 estimated population of 1,596,370. More information on the Oregon ABCs program is found at: http://oregon.gov/DHS/ph/acd/abc.shtml.

Methods

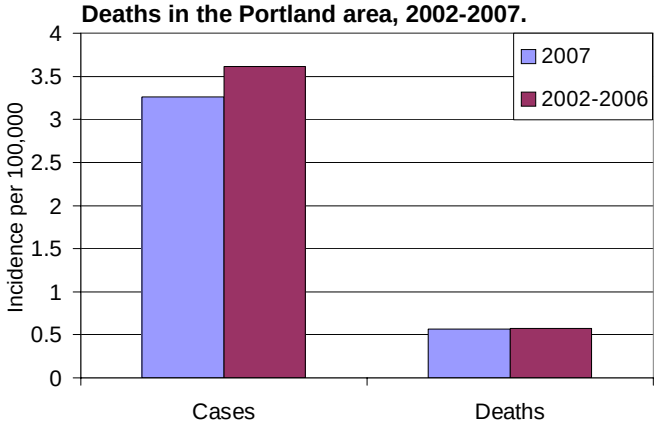
Invasive disease is defined as the isolation of GAS from a normally sterile body site or fluid or from a wound accompanied by necrotizing fasciitis or toxic shock syndrome in a tri-county resident. Tri-county hospital laboratories submit GAS isolates to the Oregon State Public Health Laboratory, which forwards them to CDC for typing. Additional cases are identified through regular laboratory record reviews. Health record reviews of each case allow standardized reports of demographic characteristics, clinical syndrome manifestations, underlying conditions, and illness outcome.

Surveillance Results

Descriptive Epidemiology

In 2007, 52 IGAS cases were reported in the Tri-County Portland area, for an incidence rate of 3.3/100,000 persons (Figure 1). This is 13% lower than the 2007 national projection of invasive disease (3.8/100,000) and 10% lower than the average annual incidence rate in the Portland area from 2002-2006 (3.6/100,000).[1] With 9 deaths reported, IGAS mortality in 2007 was 0.56/100,000 (Figure 1), similar to the 2002–2006 Portland area (0.58/100,000) and 30% higher than the 2007 national projections (0.43/100,000).[1] The mean and median ages of IGAS cases were 52 and 54 years, respectively (range: 2-88), and those of IGAS deaths were 67 and 74 years, respectively (range: 11-87). The 2007 case fatality rate for IGAS in the Portland area was 17%, compared with 16% for the Portland area from 2002–2006 and the entire ABCs network in 2007 (12%).[1] Over half of cases (58%) were male; of 26 cases where race was known, 25 (96%) where white and 1 (4%) was American Indian/Alaska Native.

Figure 1: Incidence of Invasive GAS Cases and Deaths in the Portland area, 2002-2007.



The 2007 incidence of IGAS was highest in Multnomah (4.5/100,000), followed by Clackamas (3.2/100,000), and Washington (1.6/100,000) Counties, consistent with the historical pattern. Compared with the previous five-year average, the 2007 incidence was 11% higher in Clackamas, 8% lower in Multnomah, and 32% lower in Washington counties. IGAS mortality was highest in Multnomah (0.85/100,000), followed by Clackamas (0.54/100,000) and Washington (0.20/100,000) counties. This contrasts with the five-year average, in which mortality has been highest in Clackamas county (0.84/100,000), followed by Multnomah (0.55/100,000) and Washington (0.42/100,000) counties.

Figure 2: Incidence of Invasive GAS Disease by County, 2002-2007.

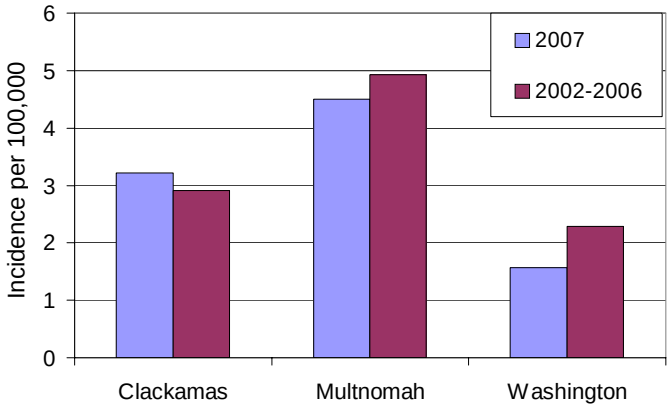
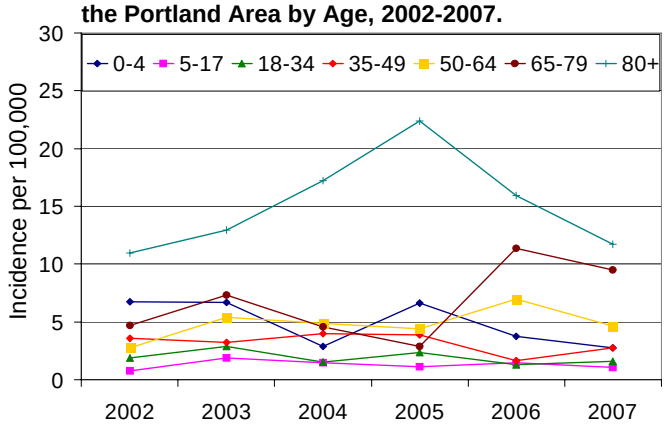


Figure 3: Incidence of Invasive GAS Disease in the Portland Area by Age, 2002-2007.



The burden of disease was highest in those ≥80 years of age (6 cases; 12/100,000 persons), followed by those 65-79 years of age (10 cases; 9.4/100,000) (Figure 3). The incidence among those 18-49 has remained largely stable, within annual variation, over the past six years. Among those 80 and over, incidence has decreased 48% since peaking in 2005 and is now only 7% higher than the 2002 incidence in this age group. While the incidence among those 65-79 is 17% lower than last year, it is yet unclear if this reflects a decreasing trend or annual variation in occurrence. Three of the nine deaths in 2007 were among persons in the eldest age group, among whom mortality was 5.9/100,000 and the case fatality was 50%. Increasing age is significantly related to fatal outcome from IGAS ($p<0.0001$).

Clinical Manifestations

The clinical syndromes of IGAS reported in 2007 were largely similar to the average profile seen from 2002-2006, with no significant differences seen either between the current and previous five years or in trends over time (Table 1). In 2007, four cases of necrotizing fasciitis and two cases of toxic shock syndrome were reported.

Table 1: Percent of Invasive GAS cases reporting common clinical syndromes.[†]

Syndrome	2007	2002-2006
Cellulitis	37	36
Bacteremia	29	26
Septic Arthritis	15	12
Pneumonia	13	15
Necrotizing Fasciitis	8	6
Abscess	8	5
Meningitis	6	2
Toxic Shock	4	5

[†] Some cases report >1 syndrome; not all syndromes shown.

The clinical syndromes of invasive GAS disease vary by age. Among cases reported since 2002, septic arthritis decreased ($p=0.0013$) and cellulitis increased ($p=0.046$) with increasing age. Additionally, among adults, necrotizing fasciitis, toxic shock, and sterile abscess infection were reported more frequently among those 18–64 years of age ($p=0.0075$, $p=0.015$, and $p=0.0032$, respectively) while bacteremia was reported among those 65 years and older ($p=0.040$).

Pneumonia, bacteremia, and necrotizing fasciitis cases were significantly more likely - and cellulitis and septic arthritis significantly less likely - to be associated with a fatal outcome among IGAS cases in bivariate analysis. After controlling for patient age, pneumonia and septic arthritis were no longer significant, while a fatal outcome was three times (95% confidence interval [CI] 1.4, 5.2) more likely among those with bacteremia, four times more likely among those with necrotizing fasciitis (CI 1.5, 12.5), and seven times less likely among those with cellulitis (CI 2.8, 17.5) than among those with other clinical manifestations.

Table 2: Percent of adult IGAS cases with reported underlying conditions, 2002-2007.†

	18-64	65+
Asthma	12	6
Blunt Trauma	14	14
Cardiovascular Disease	**12**	**49**
COPD	7	14
Diabetes	**14**	**29**
Dialysis	3	6
Immunosuppression	8	12
IDU	**15**	**0**
Obesity	8	7
Penetrating Trauma	11	6
Surgical Wound	5	3
Burns	3	2
None	**20**	**7**

†Bold type indicates a significant difference; p<0.05.

Underlying Conditions

In 2007, one child (17%) reported asthma; the remainder had no underlying conditions reported. Among adults, the profile of underlying conditions reported in 2006 was similar to that reported from 2002-2006, with the exception of burns, which was reported more frequently in 2007 (13% vs. <1%, p=0.016) (Table 2). Younger adults were more likely to report IDU or no underlying conditions, while older adults were more likely to have cardiovascular disease and diabetes. All other underlying conditions were reported similarly among all adults. After controlling for age, only immunosuppression was significantly related to fatal outcome among cases (Odds Ratio [OR] 2.8, CI 1.2, 6.4).

In terms of clinical manifestation, after adjusting for age, pneumonia was associated with immunosuppression (OR 3.0, CI 1.3, 6.9); septic arthritis a was associated with blunt trauma (OR 3.5, CI 1.5, 8.1); cellulitis was associated with penetrating trauma (OR 2.5, CI 1.1, 5.7); and necrotizing fasciitis was associated with blunt trauma (OR 3.4, CI 1.2, 9.5) and burns (OR 6.8, CI 1.2, 38.2).

Emm type Analysis

The surface M protein – a known virulence factor for disease – has been the basis for GAS strain typing for decades. Since 1995, CDC has determined the M protein type through sequencing the DNA of the corresponding gene (*emm*), providing an *emm* type.[2] In 2007, 12 *emm* types were determined for isolates from 34 cases; 18 cases are pending. The five most frequent *emm* types reported in 2007 were 1 (38%), 28 (12%), 75 (12%), 2 (9%), and 12 (9%). Since 2002, 36 *emm* types were determined for 294 isolates. The most frequent *emm* types seen over this time are presented in Table 4. Neither type 3 – traditionally one of the more common emm types identified – nor type 89 - which first emerged in Oregon in 2004 and which comprised one of the five most common emm types in 2005 – was reported in 2007.

Table 4: Selected Demographic and Clinical Attributes of Invasive GAS Disease, by Isolate *emm* Type, 2002-2007.†

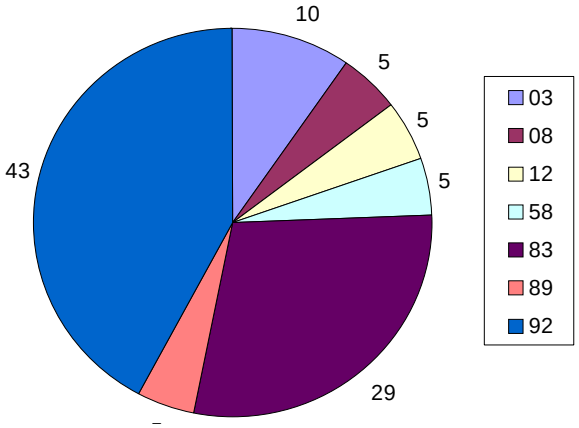
emm type	N (%)	Fatal N (%)	Age 65+ N (%)	Necrotizing Fasciitis N (%)	Pneumonia N (%)
1	71 (22)	18 (34)	15 (17)	9 (42)	21 (44)
3	15 (5)	6 (11)	3 (3)	2 (10)	1 (2)
4	16 (5)	1 (2)	5 (6)	2 (10)	0 (0)
12	28 (9)	3 (6)	9 (10)	1 (5)	5 (10)
28	23 (7)	5 (9)	13 (15)	1 (5)	1 (2)
92	30 (9)	3 (6)	2 (2)	2 (10)	3 (6)

†Percentages are number of isolates with displayed *emm* type out of the total number of isolates in that category.

Emm types 1 and 3 are both significantly associated with a fatal outcome (OR 2.6, CI 1.2, 5.3 and OR 5.0, CI 1.6, 15.9, respectively); *emm* type 1 is also associated with pneumonia (OR 3.2, CI 1.5, 6.5) and necrotizing fasciitis (OR 5.1, CI 1.5, 1.1). *Emm* type 28 is more commonly seen among adults 65 years and older (OR 3.4, CI 1.4, 8.4) and in bacteremia manifestations (OR 2.7, CI 1.1, 6.5), and *emm* type 4 is associated with cellulitis (OR 4.3, CI 1.4, 13.1)

Antibiotic susceptibility

Figure 4: Percentage of erythromycin-resistant isolates, by *emm* type, 2002-2006.



The antibiotic susceptibility profile of invasive GAS strains has been assessed at several points since the beginning of ABCs, the most recent of which occurred in 2006. Antibiotic susceptibility results are available for 118 isolates obtained from 2002-2006. Of these 100% were susceptible to penicillin, ampicillin, cefotaxime, cefazolin, and vancomycin. Twenty-six isolates (22%) exhibited some level of antibiotic resistance: four displayed intermediate resistance and 19 displayed full resistance to erythromycin alone; two were resistant to erythromycin and clindamycin.

Erythromycin resistance is not associated with any particular clinical manifestation of invasive GAS disease or with a fatal outcome. Figure 4 shows the percentage of erythromycin-resistant isolates by *emm* type. Since 2001, *emm* type 92 has accounted for a disproportionate percentage of the erythromycin-resistant isolates—43%—compared with 10% of all isolates during this time period. As such, erythromycin-resistant isolates are 6.5 times more likely to be *emm* type 92 than other *emm* types (CI 2.3, 18.2).

Discussion

Results of invasive GAS disease surveillance in Oregon in 2007 continue to portray a profile of disease similar to that seen nationally. IGAS disproportionably affects the elderly in Oregon. Additionally, the profile of invasive disease differs across the age of the population. For instance, children are much more likely to experience GAS meningitis than are adults. Among young adults, invasive disease is more likely to manifest as a sterile abscess or septic arthritis and is more likely to be associated with injection drug use or no reported underlying condition. The elderly are more likely to have systemic disease associated with chronic underlying conditions that may affect immune function. Although it is not possible to assess risk factors for disease through surveillance alone, this association has been well documented.[3]

Monitoring trends in necrotizing fasciitis and toxic shock syndrome as well as potentially-preventable nosocomial infections (such as surgical wound infections) have been objectives of IGAS surveillance through the ABCs network. That these manifestations have remained stable over the past six years is welcome news. Additionally, it is encouraging that IGAS rates have decreased since peaking in 2005. It seems as though the increased occurrence of IGAS during that time reflected the introduction of a new *emm* type isolate – type 89 – which was associated with increased disease and mortality, especially among those 80 and older. Although this *emm* type has not been identified since 2005 and rates have returned to early baseline values, surveillance will continue to monitor for changes in the profile IGAS disease in Oregon.

References:

1. Centers for Disease Control and Prevention. 2007. Active Bacterial Core Surveillance Report, Emerging Infections Program Network, Group A Streptococcus, 2006. Available at http://www.cdc.gov/ncidod/dbmd/abcs/survreports/gas06.pdf.
2. Beall B, Facklam RR, Thompson T. Sequencing *emm*-specific PCR products for routine and accurate typing of group A streptococci. *J Clin Microbiol* 1996;34:953-8.
3. Factor SH, Levine OS, Schwartz B, et al. Invasive Group A Streptococcal Disease: Risk Factors for Adults. *Emerg Infect Dis* 2003;8:970–7.